Who Values Information from a Health Plan Internet-Based Decision Tool and Why: A Demographic and Utilization Analysis

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Objectives. The aim of this study was to investigate factors associated with utilization of health plan Internet-based decision tools.

Data Sources and Study Setting. Enrollment, claims, plan design, and web transaction data during 2008 provided by a national health insurer for 253,398 subscribers from 919 employers.

Study Design. Multivariate models of the effects of demographic, health, employer, and plan benefit design characteristics on the use of the tool and its individual function categories.

Data Extraction Methods. Subscribers, who were either an individual member or a family, were included if at least one family member had 12 months of coverage in 2008. Members older than 65 and those with multiple insurance carriers were excluded.

Principal Findings. Higher education, higher income, younger age, female gender, higher co-morbidity risk, prevalence of chronic conditions, Caucasian race, and English as the primary language were positively associated with using the tool. Plan benefit characteristics such as free preventive coverage, higher deductible, moderate coinsurance rate, family coverage, and enrollment in health savings accounts were also associated with higher likelihood of using the tool.

Conclusions. Insurers provide consumers information on cost efficiency, quality, and wellness through Internet-based decision tools, but more effort is needed to reach certain demographics.

Key Words. Consumer engagement, Internet-based tools, health care information

There is growing enthusiasm for engaging consumers in the health care decision-making process. Informing consumers and activating their role in their health care could potentially improve the quality of care they receive. Individual consumers are also likely to select high-value health plans,

providers and cost-effective treatments, and they could play an important role in cost containment (Demchak 2007; Dudley et al. 2007) and exhibit improved health behaviors (Hibbard et al. 2007).

Studies of health plan choice have shown that consumers respond to information on plan quality rating by choosing higher ranked plans (Jin and Sorenson 2006). Similarly, consumers select physicians with higher quality scores when provided with information on physician ratings (Schneider and Epstein 1998; Marshall et al. 2000; Mukamel, Weimer, and Zwanziger 2004).

However, identifying effective tools that facilitate consumers' navigation of the health care system and make them more sensitive to cost and quality remains a challenge (Hibbard and Peters 2003; Fraenkel and McGraw 2007). Consumers need information to make their health care coverage decisions and once they select a health plan, they need tools to understand how their plans function (i.e., covered services, cost sharing, administration of utilization management tools). More important, consumers need information on the availability, costs, and quality of health care providers and treatment options to avoid delays in care and to be able to choose cost-effective, high-value providers and treatments.

To support such decision making, large health insurers have begun providing their members decision-support resources through Internet-based tools (e.g., myuhc.com by UnitedHealthcare [UHC]; myAetna.com by Aetna Inc; myCIGNA.com by CIGNA Corporation; myHumana.com by Humana Inc). Such Internet-based tools are typically provided at no additional charge, but consumers are rarely aware of the availability of websites provided by their employers or insurers (Bundorf et al. 2004). Little is known about how attractive these tools are and what types of members are more likely to use them. Understanding the factors associated with consumer involvement through these tools is important for improving their design to enhance consumer engagement.

For this study, we use website transaction data provided by UHC for members to investigate the demographic, health, employer, and plan benefit design characteristics associated with health plan Internet-based tool use. Launched in 2000, UHC's website myuhc.com personalizes benefits and

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claims information of members and provides information on health care providers at no additional cost to UHC members. While some basic features include giving the members the ability to print ID cards, review eligibility, look up benefits, and check claim status, some more important features are designed to improve cost efficiency of health care services received as well as to provide services to enhance the health and wellness of the consumers. For example, consumers can acquire cost estimates on numerous treatments and health services; search for providers and compare them based on quality and cost efficiency ratings at the procedure level; find discount providers; find pharmacies; acquire information on drug therapies; chat with a nurse in real time; take a health assessment and participate in health coaching programs; organize health data and receive condition-specific information; and learn about health conditions, symptoms, and the latest treatment options.

Our focus in this study is members' use of the functions designed to improve cost efficiency and those targeted at health and wellness. These functions are captured under the following major function categories of the tool: Cost Estimation Tools, Physicians & Facilities, Pharmacies & Prescriptions, and Health & Wellness (detailed below). We first identify factors that are associated with any use of the Internet-based tool across these major function categories. Second, we investigate factors that are associated with the use of each major function category separately.

Given data availability, our study population consists of members who are newly enrolled in UHC health plans and we examine their use of the Internet-based tool during the 1-year follow-up period. A key advantage of this sample selection is that it allows us to examine a period during which the Internet-based tool is likely to have the greatest value to the members as they learn about their health plan and available resources. However, one disadvantage is that we are not able to fully capture information-seeking behavior following the first year.

METHODS

Data Sources

We assembled an extensive de-identified dataset of enrollment data merged with claims and web transaction data from myuhc.com. The web transaction data are unique by subscriber, transaction date, and a 5-digit transaction code. A subscriber, sometimes referred to as a contract, can be an individual or a family. Transaction date was the date stamp created by the data system

when a click to a web page occurred. In our data, transaction date ranged from February 1, 2008, to December 31, 2008.[1] The transaction data do not allow for identifying multiple visits of the same visit type in a given day by a given subscriber. For example, if a subscriber visits five different pages on the website in a calendar day, she/he will have five records in the transaction data for that day. If she/he visits the same page repeatedly on a given day, only one record is stored for that page on that day.

A transaction code represents a unique web page. In this study, we focused our analysis on the likelihood of using web pages aimed at improving cost efficiency, quality, and health and wellness. We excluded transaction codes that were related to administrative functions (e.g., account settings, plan benefit and coverage, claims processing) because administrative information can be obtained from other resources such as plan brochures, company's human resource website, or letters of claim explanation from the insurance company. We also excluded codes that were either no longer active, or used for UHC's internal analysis only, or characterized as login visits. The final analytical file included 88 transaction codes. We defined four mutually exclusive function categories based on the description of these transaction codes: *Cost Estimation Tools*, *Physicians & Facilities, Pharmacies & Prescriptions,* and *Health & Wellness*. A detailed description of these categories is available in Table 1. A total of nearly half a million transaction records were analyzed for this study.

We also extracted information on a rich set of demographic characteristics. We supplemented these data with information on health status, plan benefit design, and employer characteristics.

Selecting Employers

While the Internet-based tool was available to UHC members since 2000, data on web transactions prior to February 2008 were not available to us. In selecting our sample, we focused on employers that did not offer an insurance product from UHC until January 2008. This restriction implied that the members were exposed to the Internet-based tool for the first time. Internet-based tool utilization during the first year is likely different than in subsequent years. Our restriction allows us focus on a period during which members likely receive greatest value from the tool as they learn about their health plan, available pharmacies and providers, as well as resources on health and wellness.

Table 1: Web Function Categorization by Transaction Code Descriptions (Total *n* = 88)

Cost Estimation Tools (n = 10)	Physicians & Facilities (n = 57)	Pharmacies & Prescriptions (n = 15)	Health & Wellness (n = 6)
Cost estimator for 200+ treatment episodes and 400+ individual health services	Find Physician/hospital Dental/vision care Discount providers Medical equipment and supplies Mental health care Pharmacies	Prescription purchasing Claims and balances Locate a pharmacy Order & refill prescriptions, Rx solutions Order status	Links to articles on hundreds of diseases, conditions, and preventive topics
Drugs	Primary care physician (PCP) assignment Search by specialties Children's health General Men's health Women's health		
Other tools FSA savings FSA OTC link Rewards for action Quicken health expense tracker	Provider rating Cost efficiency Quality	Prescription planning Benefit highlights Drug information Prescription drug list My Rx choices	Live nurse chat Personal health record (PHR)
Common questions How are cost estimated?	Common questions Change PCP Provider search Find discount providers Other Informational resources (e.g., how to choose a physician) Spanish search	Common questions Copay and coverage Saving options	Common questions Find treatment Find PHR

We identified a total of 919 employers from the group market with 100 or more employees. These employers were mostly in the private sector (96.5 percent) and on average had 578 members. Services industry was the most common (34 percent), followed by manufacturing (20 percent), and finance (12 percent). About 11 percent of the employers offered only consumer-driven health plans (CDHPs) such as Health Reimbursement Arrangements (HRAs) or Health Savings Accounts (HSAs), 70 percent of employers offered only a traditional plan such as Exclusive Provider Organizations, Preferred Provider Organizations, or Point of Services, and 19 percent offered options of traditional plan and CDHP.

Identifying Subscribers

We use subscriber as the unit of analysis instead of the individual member because the primary contract holders, typically employees, may share a common web account with their dependents, for example, spouses and children. It is also possible that one family member uses the account and reviews information for all family members.

We first excluded individual members who were 65 years or older by December 31, 2008, and those who had health plan coverage from an insurance carrier other than UHC. Next, we identified subscribers who had at least one individual member in the family with 12 months of medical and pharmacy coverage in 2008. Our final sample included 253,398 unique subscribers who represented 530,887 individual members. Half of these subscribers had family coverage ($n = 127,109$ of 253,398, 50 percent) with an average of 3.2 members in the family.

Empirical Model

Subscriber i's utility from the Internet-based decision tool (relative to an outside option of not using the tool) can be modeled as a function of the benefits received and the costs associated with using the tool:

$$U_i = \text{Benefits}_i - \text{Costs}_i \qquad (1)$$

A subscriber not using the tool could gather information from other sources or may decide not to gather information at all. As we are not able to observe consumer behavior other than the tool use, we do not distinguish between these different options and model them instead into an "outside" option and normalize the utility associated with it to zero.

In this setting, the subscriber will utilize the tool if its net benefits (the difference between benefits and costs) are greater than zero. We model these net benefits as

$$y_i^* = x\beta + \varepsilon_i \tag{2}$$

where x is a vector of subscriber-level characteristics and ε_i is an error term independently and identically distributed across all subscribers. We do not observe y_i^*, but instead observe the Internet-based tool use decision of the subscriber. If the subscriber uses the tool, then $y_i^* \geq 0$.

Accordingly, we estimated a logistic regression model where the outcome variable was an indicator for whether the subscriber had at least one visit to any of the four functions between February 2008 and December 2008. To identify the factors associated with a visit to each major function category among subscribers, we estimated separate logistic regression models for each function using the same explanatory variables as those above. The outcome variable was an indicator for whether a subscriber had at least one visit to the specific function.

Explanatory Variables

Previous research on consumer use of the Internet for seeking general health information suggests that the net benefits of searching the Internet are higher for those in poor health, those who are more efficient users of health information (e.g., the more educated), and those with more costly access to health information from sources other than the Internet (e.g., the uninsured, or those with higher out-of-pocket costs for physician visits) (Baker, Wagner, and Singer 2003; Bundorf et al. 2006). Accordingly, we included a rich set of variables that capture demographic characteristics, health status, employer characteristics, and plan benefit design attributes (detailed below) that are associated with net benefits from using the tool (equation 2).

We constructed all explanatory variables at the subscriber level. For continuous or ordinal variables such as co-morbidity risk score, the maximum value for any individuals in the family was used. For binary variables, the response was set to "Yes(Y)" for the subscriber if at least one family member had a response of "Yes" for the variable. For multilevel character variables such age ethnicity, the response of the primary subscriber (normally the employee) was used. We controlled for four categories of characteristics.

Demographic Characteristics. We obtained demographic information from UHC's enrollment database and survey data compiled by a vendor. Characteristics that were used in the multivariate models included average age of adults in the family (19–30, 30–40, 40–50, older than 50 years), having infants (0–1 year of age) in the family (Y/N), employee's gender, highest received education in the family (elementary, high school, college or graduate), employee's race/ethnicity (African American, Asian, Caucasian, or Hispanic), employee's language preference (English or Spanish), family income (<U.S.$40,000, U.S.$40,000–59,999, U.S.$60,000–74,999, U.S.$75,000–99,999, ≥U.S.$100,000), owning a major credit card (Y/N), shopping on the Internet (Y/N), exercising regularly (Y/N), home type (apartment/condo or single family house), geographic region of residency (U.S. Census Bureau 2010), and years of residency (<5, 5–10, 11–15, 16–20, ≥21). For each variable with missing information, we created a corresponding indicator variable to specify "unknown." These "unknown" indicators were included in the statistical models.[2]

Health Status. Using individual co-morbidity risk scores and chronic condition indicators, we obtained the highest co-morbidity risk score as well as the prevalence of several chronic conditions in the family. The risk scores were computed with *Episode Risk Groups* (*ERG*s) software using enrollment data and medical and pharmacy claims in 2008. *ERG* is a derivative work based on Episode Treatment Groups (ETGs) methodology, which is a widely used software product for illness classification and episode building.[3] Higher risk scores imply higher illness burden. The literature reports that *ERG* risk scores highly correlate with other risk-adjusted measures of practice efficiency, such as Adjusted Clinical Groups, Burden of Illness Score, Clinical Complexity Index, Diagnostic Cost Groups, and General Diagnostic Groups (Thomas, Grazier, and Ward 2004). We categorized the risk score into four levels by quartiles: low, medium-low, medium-high, and high.

We used ETGs to identify the presence of several chronic conditions (Y/N) in the family: asthma or chronic obstructive pulmonary disease (COPD), coronary artery disease (CAD), transplants or obesity, and diabetes. In addition, we controlled for whether any family member has a disability (Y/N).

We hypothesized that disease severity, higher socioeconomic status (measured by education and income level), and experience with using the Internet (e.g., shopping on the Internet) will be associated with a higher

likelihood of using the Internet-based health plan tool. The role of several demographic characteristics such as age, race/ethnicity and gender is ambiguous. Literature on employer-provided wellness programs suggests younger, female, and Caucasian workers are more likely to participate (Burton et al. 2005; Herman et al. 2006; Joslin, Lowe, and Peterson 2006). Similarly, subscribers with these demographics may be more likely to utilize the health plan website, especially the functions related to health and wellness.

Employer Characteristics. We controlled for the profile of products offered by the employer (whether employer provided CDHP only, traditional plan only, or choices of CDHP and traditional plan), whether an employer is in the public or private sector, size of firm if in private sector (100–3,999 employees, 4,000–4,999 employees, or 5,000+ employees), and the business industry based on the Standard Industry Code. These employer characteristics capture unobserved heterogeneity of workers across different firm size and types.

Plan and Benefit Design. Among subscribers who had a non-zero deductible, roughly half of the individual contracts had a deductible higher than U.S. $1,000 and half of the family contracts had deductible higher than U.S. $2,000. Using zero and the median of the non-zero values as the cut-off points, we constructed a three-level deductible: zero-deductible (6 percent), low-deductible (50 percent, under U.S.$1,000 for individual contracts or under U.S.$2,000 for family contracts), and high-deductible (44 percent, U.S. $1,000+ for individual contracts or U.S.$2,000+ for family contracts). The plan level coinsurance fell into four levels[4]: 0 percent (38 percent), 10 percent (23 percent), 20 percent (35 percent), and 30 percent or higher (4 percent). We also constructed an indicator on whether the subscriber had 100 percent preventive care coverage (zero copayment and zero coinsurance for wellness visits). In addition, we controlled for plan type (HRAs, HSAs, or traditional plans), contract type (single versus family), and coverage period in 2008 (full year if all members in the household had 12 months coverage versus partial year if at least one member had less than 12 months coverage).

We hypothesized that subscribers with deductibles, those with HSAs or HRAs, and those with higher coinsurance rates would have stronger incentives to use the Internet-based tool for several reasons. They would benefit

from searching for providers and identifying those with lower cost. Similarly, they would value information on treatments and drug therapies to identify cost-effective alternatives. In addition, they would benefit from utilizing the health and wellness information provided by the Internet-based tool as their relative cost of visiting a provider is higher. On the other hand, these subscribers tend to be healthier and they face higher relative price for health care services, potentially dampening their demand for health care services, and for the Internet-based tool. Even controlling for health status, we may find lower utilization of the tool by these subscribers because they have lower demand for health care services due to higher prices they face.

RESULTS

Modeling Probability of Using the Internet-Based Tool

Among the 253,398 subscribers, 30 percent ($n = 77,198$) had at least one visit to any of the four functions between February 2008 and December 2008. Table 2 reports the odds ratios (OR) for factors associated with the use of the health plan web tool.

As we had hypothesized, socioeconomic status was associated with the use of the tool. Subscribers with higher educational attainment (highest educational attainment in the family is college or higher) and those with higher household income were more likely to use the tool. Several factors that typically characterize younger families were positively associated with the tool use. These included lower average age among adults in the family, residence in an apartment/condo instead of a single family home, and less than 5 years in the residence.

In addition to subscriber demographics, several characteristics of the primary insured (employee) were also important. The likelihood of using the tool was higher if the employee was female, spoke English as her/his primary language, owned a major credit card, shopped on the Internet, and exercised regularly. Those who regularly exercise are likely to be more health conscious individuals who may benefit more from the tool in general. Those who speak English, shop with credit cards, and shop on the Internet are likely more familiar with using Internet-based applications in general, and they are also likely to be more efficient users of information provided by the health plan website. There were also racial/ethnic differences in the likelihood of using the tool with higher likelihood among Caucasian subscribers relative to Hispanic and African American subscribers.

Table 2: Adjusted Odds Ratios for Factors Associated with the Use of Web Tool (*n* = 253,398)

Explanatory Variables†	*Use of Internet-Based Tool*		
	OR	CI	Significance
Demographic characteristics			
Highest educational attainment in family (ref: at least college)			
High school	0.8	(0.78, 0.82)	***
Elementary	0.75	(0.69, 0.81)	***
Household income(ref: U.S.$60K–74K)			
U.S.$100K or above	1.02	(0.99, 1.06)	
U.S.$75K–99K	1.04	(1.01, 1.08)	**
U.S.$40K–59K	0.92	(0.89, 0.94)	***
Under U.S.$40K	0.82	(0.79, 0.85)	***
Other subscriber characteristics			
Average age of adults (ref: 50 or above)			
Under 30	1.52	(1.47, 1.57)	***
30–39	1.29	(1.26, 1.33)	***
40–49	1.05	(1.02, 1.08)	***
Presence of infant in family	1.06	(1, 1.13)	*
Home type (ref: single family home)			
Condo/apartment	1.17	(1.13, 1.21)	***
Other	0.91	(0.87, 0.96)	***
Years in residency (ref: less than 5 years)			
21	0.85	(0.82, 0.88)	***
16–20	0.89	(0.85, 0.92)	***
11–15	0.87	(0.84, 0.9)	***
5–10	0.9	(0.88, 0.93)	***
Region of residency (ref: West)			
South	1.04	(1.01, 1.07)	**
Northeast	1.08	(1.04, 1.12)	***
Midwest	1.02	(0.99, 1.05)	
Other	0.55	(0.32, 0.94)	**
Primary insured (employee) characteristics			
Female versus male	1.42	(1.39, 1.45)	***
Primary language English (ref: Spanish)			
English	1.25	(1.17, 1.32)	***
Other	1.12	(1.02, 1.22)	**
Race/ethnicity (ref: Caucasian)			
Hispanic	0.87	(0.83, 0.92)	***
Asian	1	(0.94, 1.07)	
African American	0.71	(0.69, 0.74)	***
Other	1	(0.95, 1.06)	
Exercise regularly	1.06	(1.04, 1.09)	***
Own major credit card	1.1	(1.07, 1.13)	***
Shop on the Internet	1.62	(1.59, 1.66)	***

Table 2. *Continued*

Explanatory Variables[†]	Use of Internet-Based Tool		
	OR	CI	Significance
Health status			
Highest co-morbidity score in family (ref: low)			
High	2.46	(2.38, 2.54)	***
Medium–high	2.1	(2.04, 2.16)	***
Medium–low	1.66	(1.61, 1.7)	***
Any asthma/COPD in family	1.09	(1.06, 1.13)	***
Any CAD in family	0.98	(0.94, 1.03)	
Any diabetes in family	1.09	(1.06, 1.13)	***
Any transplants or obesity in family	1.16	(1.1, 1.21)	***
Any disability in family	1.2	(0.85, 1.68)	
Employer characteristics			
Sector/size (ref: private sector, at least 5,000 employees)			
Public sector	0.54	(0.51, 0.56)	***
Private sector, 4,000–4,999 employees	0.67	(0.65, 0.69)	***
Private sector, 100–3,999 employees	0.74	(0.71, 0.77)	***
Insurance offering (ref: choice of traditional and CDHP)			
Offers only traditional plan	0.77	(0.75, 0.79)	***
Offers only CDHP	0.73	(0.7, 0.77)	***
Industry (ref: services)			
Wholesale trade	0.75	(0.72, 0.78)	***
Transportation communications electric gas and sanitary services	0.8	(0.77, 0.83)	***
Retail trade	0.61	(0.58, 0.63)	***
Public administration	0.93	(0.89, 0.97)	***
Mining	0.65	(0.56, 0.75)	***
Manufacturing	0.89	(0.86, 0.91)	***
Finance insurance and real estate	1.21	(1.17, 1.25)	***
Construction	0.84	(0.79, 0.88)	***
Agriculture forestry and fishing	0.55	(0.49, 0.61)	***
Plan & benefit design characteristics			
Deductible (ref: no deductible)			
Low deductible	1.09	(1.04, 1.14)	***
High deductible	1.09	(1.04, 1.14)	***
Coinsurance rate (ref: 0%)			
30%	0.9	(0.86, 0.95)	***
20%	0.98	(0.96, 1)	*
10%	1.04	(1.01, 1.07)	***
Free preventive care coverage	1.5	(1.47, 1.54)	***
Consumer-driven health plans (ref: traditional plans)			
HSAs	1.28	(1.22, 1.35)	***
HRAs	0.97	(0.92, 1.02)	
Family contract (versus individual)	1.54	(1.51, 1.57)	***
Full year plan coverage (versus partial year)	1.05	(1.01, 1.08)	**

Health status was also an important predictor of using the tool, as we hypothesized. Having higher co-morbidity risk score, having asthma or COPD, transplants or obesity, and diabetes in family was positively associated with using the tool.

Several employer characteristics were also associated with Internet-based tool use. Employees of large employers with 5,000 or more employees in the private sector (relative to public sector employers or private sector employers with less than 5,000 employees); of employers that provided multiple choices of health plans (relative to those providing only traditional plan or only CDHP); and of finance and real estate industry (relative to services industry) were more likely to use the Internet-based tool. These findings may reflect that larger employers, those that offer different insurance products, and those in higher income industries may have well-functioning human resource departments that promote the health plan website to the employees. In addition, these employer characteristics may capture unobserved employee heterogeneity. For example, employees who work more with computers, who are more technologically savvy, or who are trained in information seeking/searching related tasks at work may be more likely to use the Internet-based tools in general.

Finally, various plan benefit design characteristics were associated with Internet-based tool use. Subscribers who had a deductible were more likely to use the tool than those who had zero deductible. The effect of coinsurance rate was nonlinear. Relative to having a coinsurance rate of 0 percent, having a coinsurance rate of 10 percent, or lower was associated higher odds of using the tool, while having a coinsurance rate of 30 percent or higher was associated with lower odds of using the tool. As we discussed above, higher coinsurance rate may increase incentives for finding lower cost providers and treatments. However, on the other hand, high out-of-pocket costs associated with high coinsurance rate may dampen demand for health services and demand for the Internet-based tool. Subscribers who had 100 percent preventive care coverage had higher odds of using the tool. In addition, enrolling in an HSA; having a family contract relative to an individual contract; and

having full-year plan coverage were associated with a higher likelihood of using the tool.

Modeling the Probability of Visiting Individual Functions

For each of the 77,198 subscribers who were identified as Internet-based tool users, we identified whether the user visited each of the four functions. We found that Physicians & Facilities was the most frequently visited function ($n = 51,407$ subscribers), followed by Health & Wellness ($n = 36,560$), Pharmacies & Prescriptions ($n = 27,906$), and Cost Estimation Tools ($n = 24,157$).

We ran a binary logistic regression model for each function among all subscribers in the study population ($n = 253,398$) to model the probability of a subscriber visiting that specific function. The OR are reported in Table 3. In summary, most demographic, health status, and employer characteristics had similar quantitative and qualitative implications across all functional categories, while plan and benefit design characteristics had somewhat different implications across functions.

Among demographic characteristics, while higher educational attainment was associated with use of each function, higher income was not. In particular, use of Cost Estimation Tools was less likely among the highest income category (above U.S.$100K relative to U.S.$60K–74K) suggesting that higher income subscribers are less sensitive to costs. Moreover, the two highest income categories (U.S.$75K–99K and above U.S.$100K) were not associated with the use of the Health & Wellness category. This finding suggests that the highest income subscribers may prefer face to face health care visits over seeking health and wellness information online. Lower income subscribers (less than U.S.$60K relative to U.S.$60K–74K) were less likely to utilize each of the functions provided by the Internet-based tool.

Younger families characterized by younger average age among adults, condo/apartment residence, and short residence tenure were more likely to use all functions except for Pharmacies & Prescriptions. Younger average age of adults and presence of infant in the family were associated with lower odds of using Pharmacies & Prescriptions likely reflecting lower demand for prescription medicines.

Families where the primary insured was female, spoke English, exercised regularly, owned a major credit card, or shopped online were more likely to use all functions. Hispanics and African Americans were less likely to use all functions relative to Caucasians, although the estimate was not statistically significant for Hispanics use of Physicians & Facilities.

Table 3: Odds Ratio for Factors Associated with Visiting to Each Category ($n = 253{,}398$)

Explanatory Variables†	Cost Estimation Tools			Physicians & Facilities			Pharmacies & Prescriptions			Health & Wellness		
	OR	CI	Sig	OR	CI	Sig	OR	CI	Sig	OR	CI	Sig
Demographic characteristics												
Highest educational attainment in family (ref: at least college)												
High school	0.88	(0.85, 0.91)	***	0.81	(0.79, 0.83)	***	0.85	(0.82, 0.88)	***	0.83	(0.81, 0.86)	***
Elementary	0.81	(0.71, 0.92)	***	0.77	(0.71, 0.84)	***	0.67	(0.59, 0.77)	***	0.82	(0.74, 0.91)	***
Household income(ref: U.S.$60K–74K)												
U.S.$100K or above	0.89	(0.84, 0.94)	***	1.01	(0.97, 1.04)		1.05	(1, 1.1)	*	0.97	(0.93, 1.01)	
U.S.$75K–99K	1	(0.96, 1.05)		1.05	(1.01, 1.09)	***	1.05	(1.01, 1.1)	**	1.01	(0.97, 1.05)	
U.S.$40K–59K	0.95	(0.91, 0.99)	**	0.9	(0.87, 0.94)	***	0.94	(0.9, 0.98)	***	0.96	(0.93, 1)	*
Under U.S.$40K	0.88	(0.83, 0.94)	***	0.83	(0.79, 0.86)	***	0.85	(0.81, 0.9)	***	0.91	(0.87, 0.96)	***
Other subscriber characteristics												
Average age of adults												
Under 30	1.72	(1.64, 1.8)	***	1.8	(1.73, 1.86)	***	0.82	(0.78, 0.86)	***	1.55	(1.48, 1.61)	***
30–39	1.28	(1.23, 1.34)	***	1.45	(1.41, 1.5)	***	0.77	(0.75, 0.8)	***	1.37	(1.32, 1.41)	***
40–49	1.02	(0.98, 1.06)		1.15	(1.11, 1.18)	***	0.79	(0.76, 0.82)	***	1.13	(1.09, 1.17)	***
Presence of infant in family	1.14	(1.05, 1.23)	***	1.03	(0.97, 1.1)		0.69	(0.63, 0.75)	***	1.15	(1.07, 1.24)	***
Home type (ref: single family home)												
Condo/apartment	1.07	(1.02, 1.13)	***	1.24	(1.19, 1.29)	***	1.05	(1, 1.1)	*	1.09	(1.04, 1.13)	***
Other	0.9	(0.83, 0.97)	***	0.9	(0.85, 0.96)	***	0.85	(0.79, 0.92)	***	0.95	(0.89, 1.01)	
Years in residency (ref: less than 5years)												
21	0.85	(0.8, 0.9)	***	0.84	(0.8, 0.87)	***	0.95	(0.9, 1)	*	0.89	(0.85, 0.93)	***
16–20	0.91	(0.86, 0.96)	***	0.85	(0.81, 0.88)	***	0.98	(0.94, 1.03)		0.88	(0.84, 0.93)	***
11–15	0.95	(0.9, 1)	**	0.85	(0.82, 0.89)	***	0.98	(0.94, 1.03)		0.89	(0.85, 0.93)	***
5–10	0.91	(0.88, 0.95)	***	0.88	(0.85, 0.9)	***	0.97	(0.94, 1.01)		0.93	(0.9, 0.96)	***
Region of residency (ref: West)												
South	1.09	(1.04, 1.14)	***	1.01	(0.98, 1.05)		1.11	(1.06, 1.15)	***	1.07	(1.03, 1.11)	***

Table 3. Continued

Explanatory Variables[†]	Cost Estimation Tools			Physicians & Facilities			Pharmacies & Prescriptions			Health & Wellness		
	OR	CI	Sig	OR	CI	Sig	OR	CI	Sig	OR	CI	Sig
Northeast	1.01	(0.95, 1.07)		1.08	(1.04, 1.13)	***	1.05	(1, 1.12)	*	1.19	(1.13, 1.25)	***
Midwest	1.06	(1.01, 1.12)	**	0.83	(0.8, 0.86)	***	1.12	(1.07, 1.17)	***	1.24	(1.19, 1.29)	***
Other	0.52	(0.19, 1.43)		0.66	(0.37, 1.18)		1	(0.45, 2.21)		0.5	(0.22, 1.15)	
Primary insured (employee) characteristics												
Female versus male	1.52	(1.47, 1.56)	***	1.37	(1.34, 1.4)	***	1.44	(1.4, 1.48)	***	1.45	(1.41, 1.48)	***
Primary language (ref: Spanish)												
English	1.23	(1.12, 1.36)	***	1.27	(1.18, 1.35)	***	1.31	(1.19, 1.45)	***	1.11	(1.03, 1.21)	***
Other	1.26	(1.09, 1.45)	***	1.14	(1.03, 1.26)	***	1.14	(0.99, 1.32)	*	1.05	(0.93, 1.18)	
Race/ethnicity (ref: Caucasian)												
Hispanic	0.85	(0.79, 0.92)	***	0.96	(0.91, 1.01)		0.78	(0.72, 0.84)	***	0.94	(0.88, 1)	**
Asian	0.96	(0.87, 1.06)		1.07	(0.99, 1.15)	*	0.93	(0.84, 1.03)		1.03	(0.94, 1.12)	
African American	0.66	(0.62, 0.71)	***	0.72	(0.69, 0.76)	***	0.62	(0.58, 0.67)	***	0.84	(0.79, 0.88)	***
Other	0.89	(0.82, 0.98)	**	1	(0.94, 1.06)		1.02	(0.95, 1.11)		0.97	(0.9, 1.04)	
Exercise regularly	1.06	(1.02, 1.1)	***	1.05	(1.03, 1.08)	***	1.04	(1, 1.07)	**	1.08	(1.05, 1.12)	***
Own major credit card	1.09	(1.05, 1.14)	***	1.04	(1.01, 1.07)	***	1.24	(1.19, 1.3)	***	1.09	(1.05, 1.13)	***
Shop on the Internet	1.53	(1.48, 1.58)	***	1.55	(1.51, 1.58)	***	1.71	(1.66, 1.77)	***	1.4	(1.36, 1.44)	***
Health Status												
Highest co-morbidity score in family												
High	2.82	(2.67, 2.99)	***	2.34	(2.25, 2.43)	***	4.69	(4.41, 4.97)	***	2.05	(1.96, 2.14)	***
Medium–high	2.3	(2.18, 2.43)	***	1.97	(1.9, 2.04)	***	3.7	(3.49, 3.92)	***	1.75	(1.68, 1.83)	***
Medium–Low	1.76	(1.67, 1.86)	***	1.55	(1.5, 1.61)	***	2.61	(2.46, 2.77)	***	1.45	(1.39, 1.51)	***
Any asthma/COPD in family	1.18	(1.12, 1.23)	***	1.08	(1.05, 1.13)	***	1.22	(1.17, 1.27)	***	1.09	(1.04, 1.13)	***
Any CAD in family	1	(0.94, 1.06)		1.01	(0.96, 1.06)		1.07	(1.01, 1.13)	**	0.96	(0.91, 1.02)	
Any diabetes in family	1.22	(1.16, 1.28)	***	0.98	(0.95, 1.02)		1.38	(1.32, 1.43)	***	1.09	(1.05, 1.14)	***
Any transplants or obesity in family	1.27	(1.19, 1.36)	***	1.13	(1.07, 1.2)	***	1.09	(1.02, 1.16)	**	1.22	(1.14, 1.29)	***

Table 3. *Continued*

Explanatory Variables†	Cost Estimation Tools			Physicians & Facilities			Pharmacies & Prescriptions			Health & Wellness		
	OR	CI	Sig	OR	CI	Sig	OR	CI	Sig	OR	CI	Sig
Any disability in family	1.15	(0.72, 1.85)		1.56	(1.09, 2.22)	**	1.06	(0.69, 1.63)		0.94	(0.59, 1.47)	
Employer characteristics												
Sector/size (ref: private sector, at least 5,000 employees)												
Public sector	0.64	(0.6, 0.68)	***	0.78	(0.74, 0.81)	***	0.87	(0.82, 0.92)	***	0.33	(0.32, 0.35)	***
Private sector, 4,000–4,999 employees	0.85	(0.81, 0.89)	***	0.88	(0.85, 0.91)	***	0.91	(0.87, 0.95)	***	0.48	(0.46, 0.5)	***
Private sector, 100–3,999 employees	1.04	(0.98, 1.1)		1.02	(0.97, 1.06)		1.05	(0.99, 1.11)		0.45	(0.43, 0.47)	***
Insurance offering (ref: choice of traditional and CDHP)												
Offers only traditional plan	0.79	(0.76, 0.83)	***	0.87	(0.84, 0.89)	***	0.84	(0.81, 0.87)	***	0.66	(0.64, 0.68)	***
Offers only CDHP	0.77	(0.72, 0.83)	***	0.83	(0.79, 0.88)	***	0.84	(0.78, 0.9)	***	0.72	(0.68, 0.76)	***
Industry (ref: services)												
Wholesale trade	0.85	(0.8, 0.91)	***	0.88	(0.84, 0.92)	***	0.84	(0.79, 0.89)	***	0.65	(0.62, 0.69)	***
Transportation communications electric gas and sanitary services	0.84	(0.79, 0.89)	***	0.82	(0.78, 0.86)	***	0.94	(0.89, 1)	**	0.87	(0.83, 0.92)	***
Retail trade	0.73	(0.69, 0.78)	***	0.73	(0.7, 0.76)	***	0.63	(0.59, 0.68)	***	0.58	(0.55, 0.61)	***
Public administration	1.09	(1.02, 1.17)	***	0.95	(0.9, 0.99)	**	0.81	(0.76, 0.86)	***	1.07	(1.01, 1.13)	**
Mining	0.77	(0.61, 0.97)	**	0.67	(0.57, 0.8)	***	0.76	(0.61, 0.95)	**	0.66	(0.53, 0.83)	***
Manufacturing	0.95	(0.91, 1)	*	0.81	(0.78, 0.84)	***	0.96	(0.92, 1.01)		1.11	(1.07, 1.16)	***
Finance insurance and real estate	1.13	(1.08, 1.18)	***	1.07	(1.04, 1.11)		1.23	(1.18, 1.28)	***	1.28	(1.24, 1.33)	***
Construction	0.88	(0.81, 0.96)	***	0.84	(0.79, 0.89)	***	0.83	(0.77, 0.9)	***	0.93	(0.86, 1)	**
Agriculture forestry and fishing	0.57	(0.48, 0.68)	***	0.43	(0.38, 0.49)	***	0.76	(0.65, 0.88)	***	0.81	(0.71, 0.93)	***
Plan & benefit design characteristics												
Deductible (ref: no deductible)												
Low deductible	1.25	(1.16, 1.34)	***	1.06	(1.01, 1.12)	**	1.17	(1.1, 1.25)	***	1.02	(0.96, 1.09)	
High deductible	1.25	(1.16, 1.35)	***	1.04	(0.99, 1.09)		1.1	(1.02, 1.18)	***	1.05	(0.98, 1.11)	
Coinsurance rate (ref: 0%)												

Table 3. *Continued*

Explanatory Variables[†]	Cost Estimation Tools			Physicians & Facilities			Pharmacies & Prescriptions			Health & Wellness		
	OR	CI	Sig	OR	CI	Sig	OR	CI	Sig	OR	CI	Sig
30%	0.91	(0.84, 0.99)	**	0.78	(0.73, 0.83)	***	0.84	(0.77, 0.91)	***	1.12	(1.05, 1.19)	***
20%	1.03	(0.99, 1.07)		0.91	(0.89, 0.94)	***	1.05	(1.02, 1.09)	***	1	(0.97, 1.03)	
10%	1.11	(1.06, 1.15)	***	1.05	(1.02, 1.08)	***	1.09	(1.06, 1.13)	***	1	(0.97, 1.03)	
Free preventive care coverage	1.21	(1.16, 1.25)	***	1.27	(1.23, 1.3)	***	1.2	(1.16, 1.25)	***	1.79	(1.73, 1.85)	***
Consumer-driven health plans (ref: traditional plans)												
HSAs	1.27	(1.19, 1.36)	***	1.1	(1.04, 1.16)	***	1.18	(1.11, 1.26)	***	1.47	(1.39, 1.55)	***
HRAs	1.09	(1.01, 1.17)	**	1.07	(1.01, 1.13)	**	1.04	(0.96, 1.11)		0.84	(0.79, 0.89)	***
Family contract (versus individual)	1.5	(1.45, 1.55)	***	1.56	(1.52, 1.6)	***	1.38	(1.33, 1.42)	***	1.42	(1.38, 1.46)	***
Full year plan coverage (versus partial year)	1.03	(0.98, 1.09)		1.08	(1.04, 1.12)	***	1	(0.95, 1.04)		0.99	(0.95, 1.03)	

[†]For variables with missing information, indicators for "unknown" were included in the logistic regression models but not reported in this table.

*$p \leq$ .10.

**$p \leq$ .05.

***$p \leq$ .01.

CAD, coronary artery disease; CDHP, consumer-driven health plan; COPD, chronic obstructive pulmonary disease; HSA, health savings account; HRA, health reimbursement arrangement.

Families with higher co-morbidity risk score, with asthma/COPD, transplants, or obesity were more likely to use all functions. Diabetes in the family was also associated with higher likelihood of using all functions with the exception of Physicians & Facilities. CAD in the family was associated only with higher likelihood of using Pharmacies & Prescriptions, and presence of a disability in the family was associated only with higher likelihood of using Physicians & Facilities.

The use of each functional category differed the most with respect to plan and benefit design characteristics. Subscribers with deductibles were more likely to use all functions except for Health & Wellness. Individuals with higher deductibles are likely to be more sensitive to the costs of their treatments, and functions such as Cost Estimation Tools, Physicians & Facilities, and Pharmacies & Prescriptions provide information on cost-effective treatments, providers, and pharmaceuticals.

The effect of plan coinsurance differed across functional categories as well. Subscribers with coinsurance rate 30 percent or higher (relative to 0 percent) were less likely to use Cost Estimation Tools, Physicians & Facilities, and Pharmacies & Prescriptions, but more likely to use Health & Wellness. This finding may reflect that subscribers with very high coinsurance rates may use less health care services due to high out-of-pocket costs and therefore may have less incentive to compare costs of care. At the same time, they may be more inclined to substitute health and wellness information acquired online for actual health care services from providers.

Interestingly, subscribers with 10 percent coinsurance rate (relative to 0 percent coinsurance rate) were more likely to use Cost Estimation Tools, Physicians & Facilities, and Pharmacies & Prescriptions, suggesting that modest increases in cost sharing could increase incentives for searching for cost-effective treatments and drugs. The coinsurance rate of 10 percent was not a statistically significant predictor of the use of Health & Wellness functions. Those with free preventive coverage, CDHP attached to a HSA, and those with family contract were more likely to use each function.

DISCUSSION

Internet-based decision tools of health insurers are designed to support informed decision making by providing consumers information on their own health care spending and by enhancing price and quality transparency of the providers. Although such tools have become popular among

consumers, our study highlights that more effort is needed to reach certain demographics.

We found that 30 percent of the study population had used web functions that are related to cost efficiency, quality, or health improvement. Higher odds of utilization of these functions were associated with the following demographic factors: higher socioeconomic status, Caucasian race, English as primary language, younger age, experience with credit cards, and online shopping. Subscribers with lower education (less than college degree) and lower income (less than U.S.$60K) were less likely to utilize each of the functions provided by the Internet-based tool. We also found evidence for racial/ethnic disparities and language barriers in using these functions, suggesting that further efforts could be directed to reaching these demographic groups. Younger families typically were more likely to use the tool which could indicate that they are more sensitive to costs associated with providers and treatments and value health and wellness information. In addition, they may be more adapted to using online tools in general. Health status as measured by co-morbidity risk score and prevalence of chronic conditions were also associated with using the tool. As discussed earlier, some of these characteristics are directly associated with conceptually having higher benefits relative to costs from using the Internet-based tool.

Most demographic and health characteristics and employer characteristics had similar quantitative and qualitative associations with the use of each function, while plan and benefit design characteristics had different associations across functions.

An interesting observation was that subscribers with less generous plans characterized with higher deductibles (relative to zero deductible) and modestly higher coinsurance rates (10 percent relative to 0 percent) were more likely to utilize Cost Estimation Tools, Physicians & Facilities, and Pharmacies & Prescriptions, which may demonstrate an increased sensitivity to health care costs. We found a nonlinear effect of coinsurance rate such that subscribers with very high coinsurance rates (30 percent relative to 0 percent) were less likely to use each of the three functions, likely reflecting their lower utilization of health services due to high out-of-pocket costs. They were more likely to use Health & Wellness functions, suggesting that high cost-sharing deters subscribers from visiting providers and instead these subscribers utilize Health & Wellness tools provided online.

Further efforts could be directed in several directions. First, the efforts could be targeted to improve net benefits of the tool among the population who is likely to use the tool. Second, efforts could improve outreach to

populations who would, in principle, benefit from the tool but have barriers or high costs in doing so, such as the non-English speakers and lower socio-economic status subscribers.

There are several limitations in our study. First, our findings may not generalize to all Internet-based tools or to all different methods of consumer engagement. Second, our study included only subscribers who were exposed to the Internet-based tool for the first time and followed them for a year. While this design captures a period during which subscribers likely have the greatest value from the tool, it does not necessarily generalize to the needs of the more experienced subscribers as we are not able to fully capture information-seeking behavior following the first year. In future work, we plan to study how the Internet-based tool use changes as consumers learn to use it. Third, our study design does not support causal inference. For example, certain observed associations may reflect subscribers' plan selection which we are not able to model. Finally, our results do not show how the degree of consumer engagement affects health care costs or health outcomes. In future work, we are planning a study that will examine the association between using an online treatment cost estimator for specific surgeries or procedures and health care spending.

ACKNOWLEDGMENTS

NOTES

1. Web transaction data prior to February 2008 were not available.
2. The missing rate varied by variables, for example, highest received education, 6 percent; years of residency, 2 percent; home type, 15 percent; shopping on the Internet, 14 percent; ethnicity, 10 percent; language, 5 percent; owning a credit card,

14 percent. Some variables were missing for the same observations (family income, shopping on the Internet, owning a credit card, disability, and exercise, all have 14 percent missing rate). For these variables, we created one "unknown" indicator to control in the statistical models.

3. Product of Ingenix, a subsidiary of UnitedHealthcare.
4. The typical increment of coinsurance is 5 percent. In this study, the 0 percent category includes 0 and 5 percent, the 10 percent category includes 10 and 15 percent, the 20 percent category includes 20 and 25 percent, and the 30+ percent category includes all levels higher or equal to 30 percent.

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SUPPORTING INFORMATION

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Appendix SA1: Author Matrix.

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